REMARKS/ARGUMENTS

The examiner has objected to claims 1-10 because of the informality noted in item 1 on page 2 of the office action. In the objection to claims 1-10, the examiner observes that claims 1 and 6 recite the limitation "depositing tungsten metal" in line 9 of each claim and further observes that the Ti/TiN bilayer is also deposited using a clamp ring. In this regard the examiner directs applicant's attention to claim 2 and claim 6, lines 11-13. The examiner requires appropriate correction.

Claim 1 does not require using a quartz clamp ring during the formation of the barrier metal layer comprising Ti and TiN. However, original claim 2 refers to "the said" quartz clamp ring used in claim 1 and thereby implies that such a quartz clamp ring is required in claim 1. Applicant has therefore amended claim 2 to make it clear that a quartz clamp ring is employed to form the Ti and TiN as a further limitation to claim 1 from which claim 2 depends.

With respect to claim 6, applicant has deleted the phrase "depositing tungsten metal while" which appears in line 9. It is thus clear that claim 6 requires using a first quartz ring during the coating of the barrier layer; a second clamp quartz ring while forming the tungsten nucleation layer and a third clamp ring while forming a bulk tungsten layer. Claim 6 has also been amended to clarify that the clamp quartz ring which is used in forming the nucleation layer is a "**second** clamp quartz ring".

In view of the above, it is clear that the objection to claims 1-10 should be withdrawn.

The examiner has rejected claims 1-10 under 35 U.S.C. § 103(a) as being unpatentable over applicant's admitted prior art (hereinafter "APA") in view of Kinoshita et al. and Foster et al. In rejecting the claims the examiner acknowledges that the APA does not disclose the use of two CVD chambers with different clamp rings. The examiner turns to Kinoshita for this aspect of the invention. In this regard the examiner urges that Kinoshita discloses the use of two different CVD chambers to deposit the tungsten. The examiner further notes that Foster discloses the use of different clamp rings **to fit the desired surface for deposition**. In this regard the examiner directs applicant's attention to column 18, lines 37-56. The examiner argues that it would be obvious for one skilled in the art to modify the APA by using the two different CVD chambers disclosed by Kinoshita and the different sized clamp rings disclosed by Foster to arrive at applicant's claimed invention.

In rejecting claims 2-4 and 7-9 the examiner acknowledges that the cited references do not disclose the width of the different rings. However, the examiner urges that any variation in the width of the rings would be obvious in light of the cited art because the changes in ring width produce no unexpected function.

Applicant has carefully considered this rejection but it is most respectfully traversed for the reasons discussed below. Before discussing the rejection applicant wishes to remind the examiner that a critical feature of applicant's invention involves step (5) described on page 6, lines 11-14 of the specification. Step 5 involves depositing tungsten metal onto the substrate in two steps. Different size quartz clamp rings are used in each step **to control the area and thickness of the tungsten nucleation layer (50) and the bulk deposition area of the tungsten layer (60)** in order to ensure that the bulk deposition of tungsten **is onto the nucleation layer**.

It is thus clear that the quartz clamp rings used for depositing the tungsten nucleation layer and the bulk tungsten layer are different from one another and this difference is selected to produce a specific function. In particular, the different quartz clamp rings are selected to control the area and thickness of the nucleation layer and bulk deposition area of the tungsten layer **in order to ensure that the bulk deposition of tungsten is onto the nucleation layer**.

In one embodiment of the invention a quartz clamp ring is used to hold down the substrate or wafer while the barrier metal layer (Ti and TiN bilayer) is deposited onto the previously coated layer of BPSG coating on the SiO layer. The quartz clamp ring shields a circumferential portion of the wafer so that the shielded portion does not receive any of the Ti/TiN bilayer (see page 6, lines 21-26 and figure 5A).

It is to be noted that the size of quartz clamp ring 1 (exemplified as being 2 mm wide) is selected to mask a desired portion of the substrate or wafer, **not to accommodate a specifically sized wafer**.

In a preferred embodiment different sized quartz clamp rings are used to mask selected portions of the substrate or wafer during the deposition of the tungsten nucleation layer and the bulk tungsten layer. As noted in the specification, the portion of the substrate or wafer covered by the tungsten nucleation layer is different from the portion of the substrate covered by the bulk tungsten layer and this difference is attributed to the different clamp quartz rings used in these coating procedures. In the preferred embodiment the thickness of the rings masks different portions of the substrate or wafer so that the total area covered by the tungsten nucleation layer is different from the total area covered by the bulk tungsten layer. In this regard it is to be noted that the tungsten

nucleation layer 50 does not cover all of the underlying Ti/TiN bilayer 40 due to the width of the quartz clamp ring 2 as illustrated in figure 5B. Similarly the bulk tungsten layer 60 does not completely cover the tungsten nucleation layer 50 due to the width of the quartz clamp ring 3 as illustrated in figure 5C.

It is thus self-evident that the widths of the various quartz clamp rings are selected to produce a specified function which results in a coating area of bulk tungsten which is less than the coating area of the tungsten nucleation layer which in turn is less than the coating area of the underlying Ti/TiN bilayer. **In other words the clamp rings used in applicant's invention are not merely selected to accommodate different sized wafers.**

The examiner urges that Foster discloses the use of different clamp rings at column 18, lines 37-56. However, it is clear from this portion of Foster that lip 162 of the rings used by Foster are not selected to accomplish the same objective as in applicant's invention. Instead, Foster makes it clear that the lip is sized with an inwardly extending portion 167 having a different inside diameter **to thereby accommodate wafers of different sizes**, not to selectively mask areas of a single wafer. Thus, it is clear that selecting different sized lips to accommodate different sized wafers will not result in applicant's invention wherein different sized lips are used on the same substrate or wafer so that the area of the respective coatings is different **on the same wafer**.

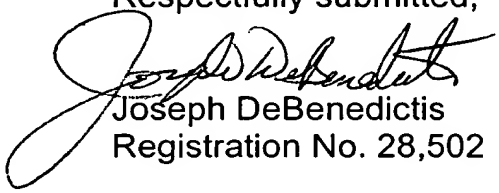
In view of the above it is clear that the feature recited in claim 1 which requires that the different quartz clamp rings are selected to control the area and thickness of the nucleation layer and bulk deposition area, is not disclosed or suggested by the combination of cited references.

Moreover, lip 162 used by Foster is placed around the periphery of a wafer and serves as a scavenger. It is thus clear that the technical feature disclosed by Foster and its effect are clearly different from those of the clamp rings used in applicant's invention.

The examiner has also rejected claims 11 and 12 under 35 U.S.C. § 103(a) as being unpatentable over the APA in view of Kinoshita and Foster as applied to the above discussed rejection and further in view of Merchant. Applicant submits that this rejection is also improper and should be rescinded since it depends on the teaching of Foster which, as discussed above, does not lead one to the applicant's invention. Moreover, the examiner relies on the teaching of Merchant for the rapid thermal annealing step required in claims 11 and 12. The technique of rapid thermal annealing disclosed by Merchant is different from the rapid thermal **nitridation used in applicant's invention**. In this regard it is to be noted that applicant sputter coats a layer of titanium and then subjects the outer surface of the titanium to nitridation to produce the outer TiN layer. Furthermore the rapid thermal annealing technique used by Merchant is carried out **after** forming the Ti/TiN bilayer which further underscores the fact that the two techniques are different from one another.

In view of the above arguments and amendment to the claims, applicant respectfully requests reconsideration and allowance of all the claims which are currently pending in the application.

Respectfully submitted,



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